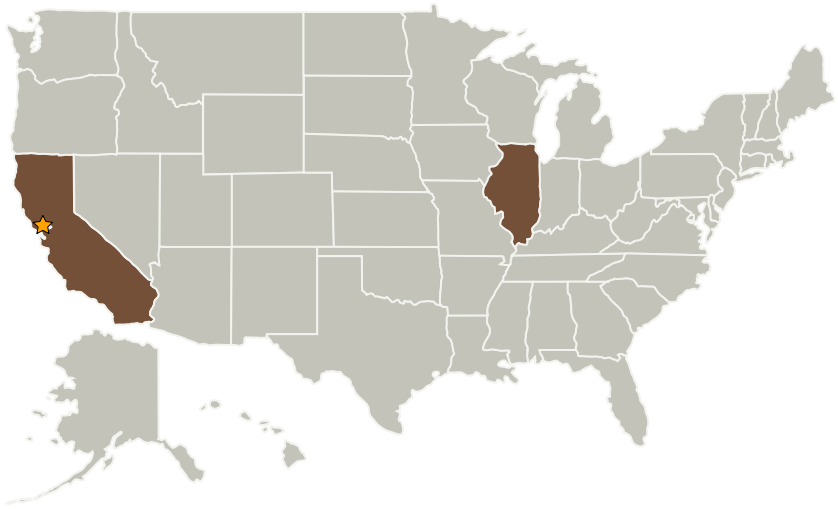
# Efficient Techniques for Formal Verification of PowerPC 750 Executables, Phase I

Completed Technology Project (2008 - 2008)

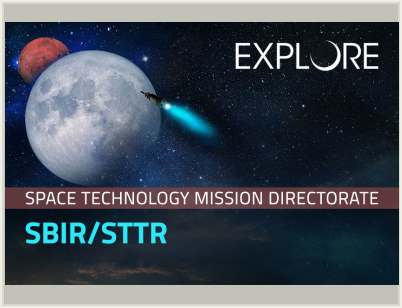
## Project Introduction

We will develop an efficient tool for formal verification of PowerPC 750 executables. The PowerPC 750 architecture is used in the radiation-hardened RAD750 flight-control computers that are utilized in many space missions. The resulting tool will be capable of formally checking: 1) the equivalence of two instruction sequences; and 2) properties of a given instruction sequence. The tool will automatically introduce symbolic state for state variables that are not initialized and for external inputs. We bring a tremendous expertise in formal verification of complex microprocessors, formal definition of instruction semantics, and efficient translation of formulas from formal verification to Boolean Satisfiability (SAT). We will also provide formally verified definitions of the PowerPC 750 instructions used in the project, expressed in synthesizable Verilog; these definitions could be utilized for formal verification and testing of PowerPC 750 compatible processors, for FPGA-based emulation of PowerPC 750 executables, as well as in other formal verification tools to be implemented in the future.

## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Ames Research Center(ARC) | Lead Organization | NASA Center | Moffett Field, California |
| Aries Design Automation, LLC | Supporting Organization | Industry | Chicago, Illinois |




Efficient Techniques for Formal Verification of PowerPC 750 Executables, Phase I

## Table of Contents



## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Ames Research Center (ARC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

# Efficient Techniques for Formal Verification of PowerPC 750 Executables, Phase I

Completed Technology Project (2008 - 2008)

| Primary U.S. Work Locations | |
|---|---|
| California | Illinois |

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Miroslav Velev

## Technology Areas

**Primary:**

- TX04 Robotic Systems
  - TX04.6 Robotics Integration
    - TX04.6.3 Robot Software